EA-1097; Environmental Assessment for the Solid Waste Disposal - Nevada Test Site, Nye County, Nevada, August 1995

Table of Contents

Acronyms and Abbreviations
1.0 INTRODUCTION

- 1.1 Purpose and Need
- 1.2 Scope of Environmental Assessment (EA)
- 1.3 Existing Solid Waste Management Program at the NTS
- 1.3.1 Area 9 Landfill
- 1.3.2 Area 23 Landfill

2.0 PROPOSED ACTION AND LANDFILL ALTERNATIVES

- 2.1 Proposed Action
- 2.1.1 Modified Use of the Area 9 Landfill
- 2.1.2 Continued Use of Area 23 Landfill
- 2.2 No-Action Alternative
- 2.3 Build New Construction and Demolition Landfill
- 2.4 Single Landfill On-Site Disposal Alternative
- 2.5 Offsite Disposal Alternative
- 2.6 Alternatives Eliminated From Further Discussion

3.0 AFFECTED ENVIRONMENT

- 3.1 Topography
- 3.2 Climate and Meteorology
- 3.3 Air Quality
- 3.4 Geology and Soils
- 3.5 Hydrology and Water Resources
- 3.5.1 Surface Water
- 3.5.2 Groundwater
- 3.5.3 Water Supply
- 3.6 Biological Resources
- 3.7 Cultural Resources
- 3.8 Socioeconomics
- 3.9 Transportation

4.0 ENVIRONMENTAL EFFECTS

- 4.1 Topography
- 4.2 Climate/Meteorology
- 4.3 Air Quality
- 4.4 Geology and Soils
- 4.5 Hydrology and Water Resources
- 4.6 Biological Resources
- 4.7 Cultural Resources
- 4.8 Socioeconomic Effects
- 4.9 Health Effects

4.10 Transportation Effects

5.0 CUMULATIVE IMPACTS
6.0 ACCIDENT SCENARIOS
7.0 COMPLIANCE WITH OTHER REGULATIONS

7.1 Clean Water Act
7.2 Clean Air Act
7.3 Safe Drinking Water Act (SDWA)
7.4 RCRA

8.0 CONCLUSION
9.0 AGENCIES AND PERSONS CONSULTED
10.0 REFERENCES

List of Figures

Figure-1 Nevada Test Site Location Map
Figure-2 Nevada Test Site with Locations of Landfills
Figure-3 Topography Map of Area 9 Landfill
Figure-4 Topographic Map of Area 23 Landfill
Figure-5 Nevada Test Site Topography Map

List of Tables

Table 1. Comparison of Proposed Action with Alternatives

Acronyms and Abbreviations

C&D
: Construction and Demolition

CFR
: Code of Federal Regulations

DOE
: Department of Energy

DOE/NV
: U.S. Department of Energy Nevada Operations Office

EA
: Environmental Assessment

EPA
: Environmental Protection Agency

ESA
: Endangered Species Act

LGFSTF
: Liquid Gaseous Fuels Spill Test Facility

NAAQS
: National Ambient Air Quality Standards

NAC
: Nevada Administrative Code

NDEP
: Nevada Division of Environmental Protection

NDHPA
: National Division of Historic Preservation and Archeology

NEPA
: National Environmental Policy Act

NR
: National Register of Historic Places

NRS
: Nevada Revised Statutes

NTS
: Nevada Test Site

RCRA
: Resource Conservation and Recovery Act

REECo
: Reynolds Electrical and Engineering Company, Inc.

RWMS
: Radioactive Waste Management Site

SDWA
: Safe Drinking Water Act

SHPO
: State Historic Preservation Officer

USCS
: United States Conservation Service

1.0 INTRODUCTION

1.1 Purpose and Need

The U.S. Department of Energy, Nevada Operations Office (DOE/NV) and their operating contractor Reynolds Electrical & Engineering Co. Inc. (REECo), own and operate, respectively, two municipal solid waste landfills at the Nevada Test Site (NTS). The NTS is located in southern Nevada (Figure 1).

In November, 1993, the Nevada Division of Environmental Protection (NDEP) solid waste regulations were amended to reflect changes in the Environmental Protection Agency's federal solid waste program published on October 9, 1991 in the *Federal Register* (56 FR 50978). The new solid waste regulations require that the existing NTS municipal landfills, which receive less than 20 tons of waste per day on an annual average, be permitted or closed by October 9, 1995. In order to be permitted, existing landfills must meet specific location, groundwater monitoring, design, operation and closure requirements. Landfills that cannot meet the regulatory requirements will not be able to obtain permits and therefore will not be able to remain in operation past the effective date.

The NTS has two municipal landfills located in Area 9 and Area 23 that are subject to the new regulations (Figure 2). The Area 9 Landfill is located within an underground nuclear detonation subsidence crater with fracture zones that may create preferential pathways for the rapid downward infiltration of water. This landfill does not meet the design requirements of the subject regulation and must cease operations by October 9, 1995. The Area 23 landfill also does not meet design requirements and will require the installation of groundwater monitoring wells or a comparable system.

There is a definite need for the continued disposal of solid waste. This waste must be disposed of properly to ensure environmental compliance with all applicable federal, state, and local regulations. The purpose and need of DOE/NV is to provide the most practical, cost-effective, and environmentally sound means to dispose of solid waste.

1.2 Scope of Environmental Assessment (EA)

This EA addresses the potential impacts of the proposed and alternative actions in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, 42 USC Section 4321 et. seq., and follows the

applicable policies and procedures for DOE/NV compliance with NEPA set forth in 10 Code of Federal Regulations (CFR) Part 1021 published in the *Federal Register* (57 FR 15122 April 24, 1992).

FIGURE 1: NTS IN THE WESTERN UNITED STATES

FIGURE 2: LOCATIONS OF AREA 9 AND 23 LANDFILLS

1.3 Existing Solid Waste Management Program at the NTS

There are two landfills at the NTS which are currently being used for the disposal of solid waste. These are the Area 9 landfill and the Area 23 landfill. Under NAC 444.571, both of these landfills are considered Class II landfills because they each accept less than 20 tons per day of solid waste for disposal.

The operation of each landfill is similar. Refuse is delivered to the disposal sites in 28 cubic yard compaction trucks or in flatbed and dump bed trucks with improvised cargo compartments. An attendant is on duty during hours of operation. The attendant controls access to the landfills and maintains records and a logbook of incoming waste shipments. The solid wastes are dumped and then spread into layers that do not exceed 2 feet prior to compaction. A layer of cover material compacted to a uniform depth of 1 foot is placed daily on all surfaces of the fill except those where operation will continue the following day. A minimum layer of 6 inches of compacted soil is maintained at all times. Any cracks, depressions and erosion of the cover are promptly repaired.

1.3.1 Area 9 Landfill

The Area 9 landfill is located in the northeast part of the NTS. The landfill is located in crater U10c. This subsidence crater was formed as a result of a subsurface nuclear detonation test which took place in the early 1960s. Many of the underground nuclear tests were detonated at or below the water table, resulting in contamination of the groundwater. Programs to evaluate the effects of nuclear testing have been under way since 1957. More recently, the Underground Test Area (UGTA) subproject was developed to identify risks posed to the public and the environment from underground nuclear testing and to determine the types of remedial actions necessary to reduce those risks to acceptable levels. A facility is scheduled to be built in the near future to treat any contaminated groundwater recovered through the UGTA program. Studies are also being conducted to determine the effects of underground nuclear testing on soils.

The Area 9 landfill opened in 1971 and originally received waste from the northern portions of the NTS. The landfill is an open, circular pit with steep, almost vertical sides (Figure 3). The current capacity of the landfill is approximately 1.3 million cubic yards. Prior to the development in 1976 of Resource Conservation & Recovery Act (RCRA) regulations governing the disposal of hazardous wastes, solid and liquid wastes were indiscriminantly disposed of in the landfill. Since 1976, the landfill has received construction and demolition waste including: paper, cardboard, vehicle parts, glass, concrete, gypsum board, non-salvageable scrap metal and wood, and other materials. However, because of its classification as a Class II landfill, it is technically allowed to receive all types of non-hazardous solid waste excluding radioactive waste, free liquids and asbestos. A separate trench or cell is used for the disposal of dead animals. The cell is identified by concrete markers. Currently, the Area 9 landfill is open to accept solid waste Monday through Thursday, from 8 a.m. until 5 p.m. The Area 9 landfill disposes of an estimated 6800 tons of solid wastes annually.

FIGURE 3: TOPOGRAPHIC MAP OF AREA 9 LANDFILL

FIGURE 4: TOPOGRAPHIC MAP OF AREA 23 LANDFILL

1.3.2 Area 23 Landfill

The Area 23 landfill is located in the southern portion of the NTS, approximately 0.5 miles southwest of

Mercury. It was constructed in 1952 north of the current location and was originally designated as a Class I landfill. The landfill is an open, rectangular pit with steep, nearly vertical sides (Figure 4). The current capacity of the landfill is approximately 588,000 cubic yards.

This landfill is open to receive all types of non-hazardous solid waste because of its Class II designation. Wastes are compacted and covered to form layers. Hospital waste, dried and characterized sewage sludge, dead animals and asbestos-containing materials are buried in separate cells which are identified by concrete markers. Currently, the Area 23 landfill requires 3 people for daily operations and is open Monday through Thursday, from 8 a.m. until 5 p.m. The Area 23 landfill annually receives approximately 830 tons of solid waste.

2.0 PROPOSED ACTION AND LANDFILL ALTERNATIVES

2.1 Proposed Action

DOE/NV proposes to continue the on-site disposal of solid waste at the Area 9 and Area 23 landfills until the compliance deadline of October 9, 1995. At that time, the Area 9 Landfill would undergo a partial closure and reopen as a Class III Construction & Demolition (C&D) landfill. The Area 23 landfill would remain in operation as a Class II landfill but would be modified to comply with state regulations. Permits to operate the Area 9 and Area 23 landfills would be required under Nevada Administrative Code (NAC) 444.6405. Prior to issuance of the permits, design modifications and closure plans required by state regulations must be addressed in the permit applications.

A state of Nevada regulated C&D Class III landfill may only accept waste materials which are inert or unlikely to create an environmental hazard or threaten the health of the general public. As a Class III landfill, the Area 9 disposal site would receive inert wastes generated by construction, demolition and/or modification of structures on the NTS. Construction debris currently comprises approximately 80% of the current NTS solid waste stream. The other 20% of putrescible and non-putrescible wastes would be disposed of in the Area 23 landfill.

2.1.1 Modified Use of the Area 9 Landfill

Partial closure of the Area 9 landfill would include construction of a barrier layer to isolate the Class II waste that was disposed of prior to the October 9, 1995 deadline. A two to five foot layer would be constructed of native material to meet state requirements for infiltration layers as specified in NAC 444.6891.2(a). The soil would be obtained from an undisturbed area located in the vicinity of the crater. Baseline moisture measurements would be obtained through the installation of approximately nine neutron monitoring tubes inside the crater. One neutron tube would also be placed outside the crater to provide background measurements. After baseline moisture measurements were obtained, the disposal of inert construction and demolition wastes could be resumed. The total cost for construction of the infiltration layer is estimated to be $663,000. The cost includes engineering, construction, contingencies, and an environmental evaluation. Construction of the barrier layer and placement of the neutron tubes would take approximately three months. Beginning October 9, 1995 and until the Area 9 landfill is reopened as a Class III operation, all waste currently going into the Area 9 landfill would be either be disposed of in the Area 23 landfill or temporarily stored in an area adjacent to the crater rim.

Upon reclassification as a Class III landfill, the life expectancy of the Area 9 disposal site would be at least 70 years, based upon the current waste production rate of 18.6 tons per day of C&D wastes. This rate is expected to remain about the same even with future construction and building demolition.

When the Class III landfill is closed after an estimated 70 years, the final closure plan outlined in the permit application would be implemented. The plan would include a final cover and construction of a retention pond south of the landfill. Material excavated for the final cover would be obtained near the future location of the retention pond. The pond would be connected to the landfill by a concrete drain pipe. The cover would include an infiltration layer overlain by an erosion layer. Specifications of the cover will be influenced by the site topography and the effectiveness of the cap placed over the Class II portion of the landfill. Prior to final closure

of the Class III landfill, a final, revised closure plan would be developed and submitted to the state for approval. Any additional concerns related to the previous Class II operation would also be evaluated as part of the final closure of the facility.

2.1.2 Continued Use of Area 23 Landfill

In conjunction with the partial closure and resumed operation of the Area 9 landfill, the Area 23 landfill would continue to operate but would only receive putrescible and nonputrescible waste. In order to comply with state regulations, the landfill would be modified to include systems for run-on/run-off control and to monitor groundwater through the installation of wells or other alternatives. Studies are currently being conducted to design these systems and estimated costs are not yet available.

Based on the present rate of production and a current landfill capacity of 558,000 cubic yards, the landfill could last approximately 100 years. Requirements for final closure of the landfill are similar to those for the Area 9 landfill in that a final, revised closure plan would need to be submitted for state approval.

2.2 No-Action Alternative

The no-action alternative would not meet the need of DOE/NV; however, assessment of the no-action alternative is required by section 1021.321 of the DOE NEPA Implementing Procedures and Guidelines (10 CFR 1021).

Under the no-action alternative, use of the existing landfills without any modifications or the installation of groundwater monitoring systems would continue beyond the permitting deadline of October 9, 1995. If a site is not closed within 30 days of the deadline, it may be declared an "open dump" by NDEP. Under the Nevada Revised Statutes (NRS), the NDEP may issue a court order and commence court action (NRS 444.592). Civil penalties up to $5,000 per day may be assessed and action may be brought to recover actual costs (NRS 444.596, NRS 444.598).

Continued operation of the landfills under these conditions would result in willful violation of state and federal laws. With no place to legally dispose of solid wastes, NTS activities would be severely limited. The "No-Action" alternative, therefore, is not an acceptable or reasonable alternative.

2.3 Build New Construction and Demolition Landfill

This alternative would include the design and construction of a new landfill for the disposal of C&D wastes. The Area 23 landfill would continue to operate as described in Section 2.1.2. The Area 9 landfill would undergo final closure as described in Section 2.1.1.

The proposed landfill would be approximately 450 feet wide by 400 feet long by 24 feet deep. With a total capacity of 160,000 cubic yards, the landfill would occupy approximately nine acres in an existing borrow pit. It would be located in Area 5, approximately three miles south of the Radioactive Waste Management Site (RWMS), and would be accessed by the 5-05 Road. The landfill could be cleared initially for a capacity of 35,000 cubic yards, with room for expansion in the future to fill the entire bermed area of 160,000 cubic yards. The new construction would include a curbed concrete pad for storage tank dismantling, fencing and gates, run-on control berms, drainage ditches and culverts. An existing dirt access road would be widened and upgraded. The cost to design and construct the landfill would be approximately $720,000. An additional estimated $200,000 would be needed to drill holes to test the permeability of the soil required for this project.

The life expectancy of a new C&D landfill at the current design capacity is only 13 years. This could be increased to 20 years through a lateral expansion of the facility. This expansion could easily be accomplished since the proposed location of the facility is surrounded by undeveloped land. It is possible that groundwater monitoring would not be required for the landfill because of the narrow range of C&D waste that would be

accepted. If this alternative were chosen, a request for a waiver for the exclusion of groundwater monitoring would be submitted to the NDEP.

Operation of a new landfill would be similar to that described in Section 1.3 for the existing municipal landfills. Equipment used to operate the landfill would be relocated from the Area 9 U10c crater landfill and would include a truck scale and office/transportainer. Two individuals would be required to operate the landfill which would be open Monday through Friday from 8:00 a.m. until 5:00 p.m. The landfill would have an estimated life span of 20 years, based on the current waste production rate of approximately 18.6 tons per day of C&D wastes.

2.4 Single Landfill On-Site Disposal Alternative

Under this alternative, the Area 23 landfill would be used for the disposal of all solid waste on the NTS. The modifications discussed in Section 2.1.2 would need to be implemented to meet state regulations. The Area 9 landfill would undergo final closure as described in Section 2.1.1

Use of only the Area 23 landfill for all solid waste would reduce the life span of this landfill to an estimated 14 years at which time an alternative disposal means would have to be pursued. The valuable space that is saved by segregating the putrescible and nonputrescible wastes from C&D waste is lost by this alternative. If it were only to receive putrescible and nonputrescible waste, the landfill could last approximately 100 years. There would be at least an additional 10,000 hours of travel time associated with the hauling of the C&D wastes to the Area 23 landfill if this was the only landfill open to accept waste. Also, in order to not disrupt the solid waste disposal process, a new means of solid waste disposal would need to be initiated prior to the end of the useful life of the Area 23 landfill. A separate EA would need to be developed to address the various disposal options, which could include expansion of the Area 23 landfill, construction of a new landfill, or disposal at an offsite facility.

2.5 Offsite Disposal Alternative

Shipping waste offsite is not a preferred alternative due to the exorbitant cost and level of effort required to process the waste prior to shipment,document that the waste is not radioactively contaminated, and transport the waste to an offsite landfill. The nearest permitted landfill is located in Apex, Nevada, approximately 145 kilometers (90 miles) away. Under this alternative, the Area 9 landfill would undergo final closure as described in Section 2.1.1. The Area 23 landfill would continue to operate as described in Section 2.1.2. Prior to the receipt of solid waste at an offsite landfill, certification would be required to verify that the waste was neither hazardous or radioactive. Certification of the waste would be performed at the NTS.

A processing plant would need to be built for this activity. Processing procedures would include opening each container of waste and examining the contents for hazardous substances. From the processing plant, the wastes would be taken to a transfer station. Prior to being shipped off site, the containerized wastes would undergo a health protection survey, including field instrumentation and swipe analyses, to ensure they were not radioactive. A property control pass would need to be obtained to take the waste offsite. Two trips per day would be required to transport the approximately 23 tons of waste from the NTS transfer station to the Apex facility.

Although it is a Class I landfill, the Apex landfill is regulated by the same waste acceptance criteria that govern the NTS landfills. NAC 444.644 through NAC 444.656 specify the disposal of special wastes, including medical wastes, waste tires, construction and demolition wastes, and sewage sludge.

Impacts to the transportation route would be minimal, since there would be no hazardous or radioactive materials present in the waste shipments. The main portion of the waste would consist of construction debris. Any accidents that did occur would be in sparsely populated areas, since all but approximately ten miles of the entire route is a four-lane highway.

Costs associated with the offsite disposal alternative include construction and operation of a Material Processing Facility, transportation of waste to the Apex facility, and disposal of the waste. A minimum initial cost of $2 million would be required for construction of a Material Processing Facility. Total annual costs for operation of

the facility plus transporting and disposing the waste would be approximately $355,000. Noncompliance with the waste acceptance criteria could result in violations and sizeable fines. For example, if any hazardous wastes were found at the Apex landfill that could be traced back to DOE or any of the contractors present at the NTS, RCRA penalties of up to $25,000 per day per incident could be levied against DOE or its contractors (RCRA Section 3008).

2.6 Alternatives Eliminated From Further Discussion

Other alternatives which were examined and not considered for further evaluation concerned the final closure of the Area 9 landfill. Under "clean closure," the wastes and the soil in the crater would be characterized and removed. Based on sample analysis results, any contaminated soils designated "RCRA hazardous" would be disposed of at an off-site facility. Any non-RCRA hazardous soils could be disposed of either at an NTS landfill or at an offsite facility. Following the removal of the wastes and contaminated soil from the landfill, uncontaminated soil would be obtained from a nearby location and used to fill the crater. The volume of soil that would need to be removed is unknown.

A second closure option would include leaving the existing wastes and soil in place and bringing in uncontaminated soil to form a cover with a three percent grade. The approximate cost of this option is $6 million.

FIGURE 5. NEVADA TEST SITE TOPOGRAPHY MAP

3.0 AFFECTED ENVIRONMENT

3.1 Topography

The NTS occupies 3,500 square kilometers (1,350 square miles) of federally owned land in Nye County, Nevada and is located approximately 105 kilometers (65 miles) northwest of Las Vegas. It is bordered on the north, west, and east by the Nellis Air Force Bombing Ranges and is bordered on the south by federally-owned land which is managed by the Bureau of Land Management.

The NTS is in the southern Great Basin region of the Basin and Range Physiographic Province (Figure 5). The Province is characterized by a series of north-south trending mountain ranges separated by broad alluvial valleys. The higher elevations on the NTS are on Pahute Mesa, approximately 2,205 meters (7,235 feet) and Rainier Mesa, 2,345 meters (7,649 feet) above sea level. The lowest elevations are in Frenchman Flat and Jackass Flat, both at approximately 910 meters (3,000 feet) above sea level (ERDA, 1977).

The existing and proposed landfills are all located in topographically closed drainage basins. Area 9 is located in the northeast portion of the NTS, at the northern end of Yucca Flat. Yucca Flat is an elongated, closed drainage basin which trends north-south. This portion of the NTS is characterized by numerous emplacement holes and subsidence craters resulting from underground nuclear testing. The craters are formed as a result of vaporization of rock and soil at the point of detonation which leads to collapse of the overlying rock and soil. The Area 9 Landfill is located within the U10c subsidence crater. The Area 23 Landfill is located approximately 0.5 miles southwest of the Mercury Base Camp and is bordered on all sides by mountains. Area 5 is located in Frenchman Flat, which is situated on an alluvial fan that slopes gently toward Frenchman Lake. The alternative Area 5 C&D landfill would be located in the southwest portion of Frenchman Flat, approximately 800 meters (0.5 miles) west of Frenchman Lake (USGS Map).

3.2 Climate and Meteorology

The NTS is a mid-latitude desert characterized by extreme summer temperatures, large daily temperature variations, and very low precipitation. It is a very arid region where the evaporation rate is many times greater than the precipitation rate. Skies are relatively clear during most seasons and the humidity is low.

Average daily temperatures at the NTS are lowest in January, 2·C (35·F) and highest in August, 24·C (75·F), with extremes of -34·C (-30·F) and 46·C (115·F). Daily temperatures may vary widely, mainly on valley floors. Average daily minimum temperatures on sloping terrain are from generally 3-6·C warmer than on the valley floors with a corresponding reduction in the average daily range.

Annual precipitation varies according to elevation, ranging from approximately 10 centimeters (4 inches) at an elevation of 910 meters (3,000 feet) in Frenchman Flat to 30 centimeters (12 inches) at an elevation of 2,150 meters (7,000 feet) on Pahute Mesa. Summer rainfall may occur as intense thunderstorms that result in local flash floods. In the winter, precipitation may occur as snow, especially at the higher elevations (ERDA, 1977).

Wind patterns at the NTS are influenced by the movement of major air-pressure systems, movements due to regional topography, and localized effects due to terrain (Quiring, 1968). Southerly winds predominate in the summer, and northerly winds are more common in the winter. The wind direction also varies with the time of day, with southerly winds occurring during the day and northerly winds at night (ERDA, 1977). Wind speeds at the NTS are generally strong in the spring, with averages of 9 meters/second (20 miles/hour) during spring afternoons, and mild in the fall. Gusts may occur throughout the year, usually in conjunction with late summer thunderstorms.

The general climatic conditions presented above are assumed to be similar for the landfill sites in Areas 9, 23 and 5 with little or no variations.

3.3 Air Quality

Except for fugitive air emissions of particulate matter, the NTS has no significant known sources of pollutants for which air quality standards exist. Air quality at the NTS meets the applicable state and federal standards. In a study conducted in 1990, ambient monitoring stations were erected in Areas 6, 12, and 23. National Ambient Air Quality Standards (NAAQS) parameters that were monitored included nitrogen dioxide, sulphur dioxide, carbon monoxide, and particulate matter less than 10 microns in diameter. Maximum concentrations measured at the NTS were well below the limits set by the NAAQS. Instances of high concentrations of particulate matter in the air are common and are proportional to the wind strength/velocity and to the number of land disturbances in the area (Engineering-Sciences, 1990).

3.4 Geology and Soils

There are three major rock units which predominate at the NTS: complexly folded and faulted sedimentary rocks of the Paleozoic age, volcanic tuffs and lavas of the Tertiary age, and alluvium of late Tertiary and Quaternary age. In many places the Paleozoic sediments are overlain by the volcanic tuffs and lavas. The alluvium was derived from the erosion of the nearby hills composed of Tertiary and Paleozoic rocks (ERDA, 1977).

The Area 9 and Area 23 landfill sites are located on quaternary alluvium derived from the erosion of nearby hills, as is Area 5. Therefore, the development of the soils at these landfill sites is very similar to that of Frenchman Flat. These soils are generally a fine to loamy sand in the pH range of 8.0 to 8.5 and a water content of approximately 8.0 percent (Kearl, 1982).

Frenchman Flat is a structural feature which formed during the Tertiary Period. The bedrock of the basin is composed of Paleozoic carbonate rocks. The basin is filled with over 1200 meters of Tertiary ashflow and ashfall tuff and Quaternary tuffaceous alluvium. The alluvium consists of unconsolidated, discontinuous layers of gravel, sand, silt, and clay. The alternative C&D landfill location is on an alluvial fan deposit on the margin of the basin (ERDA, 1977).

At Frenchman Flat, the soils are characteristic desert soils formed slowly under conditions of low moisture and high temperatures. The high carbonate content derived from the parent material, limestone, has led to the development of a restrictive hardpan in some portions of Frenchman Flat (Kearl, 1982). Core samples obtained

at the Area 5 RWMS indicated that soil materials are weakly cemented and are composed mainly of tuff clasts with some clasts of quartzite and limestone. The majority of the samples were classified as either poorly-graded or well-graded sand with silt. A small portion of the samples contained significant amounts of gravel or clay (REECo, 1993).

3.5 Hydrology and Water Resources

3.5.1 Surface Water

The Great Basin can be characterized as a closed surface drainage basin. Most of the streams and rivers drain to playa lakes where the water evaporates. There are no perennial streams on the NTS. Flows in stream channels are ephemeral, occurring only after significant precipitation events. Preliminary data indicates that none of the landfills are or would be located within a 100-year flood hazard zone (ERDA, 1977 and RSN, 1993).

The sources of surface water at the NTS are precipitation and the associated runoff from the surrounding mountains. Intense or persistent storms on the NTS result in surface water runoff. The rainfall quickly infiltrates the moisture-deficient soil or runs off in normally dry channels, where it seeps into permeable sands and gravels. During extreme conditions, however, flash floods may occur. Runoff in the eastern half of NTS ultimately collects in the lake beds (playas) of the closed basins, Yucca Flat and Frenchman Flat. The presence of the hardpan in the closed basins causes the runoff to accumulate in shallow ponds. These ponds will normally evaporate anywhere from a few hours to a few weeks, depending on their size and the time of year (ERDA, 1977). Ponding may also occur in nuclear subsidence craters, where the steep sides of the craters provide runoff to the bottoms of the craters.

The western half and southernmost part of the NTS have integrated channel systems that carry the runoff beyond the NTS boundaries during the high intensity storms. Three major tributaries originating on the NTS drain into the normally dry Amargosa River channel about 32 kilometers (20 miles) southwest of the NTS. Forty mile Canyon is the largest of these systems. The other major NTS tributaries to the Amargosa River are the Topopah Wash and Rock Valley. Runoff in Area 23 can expected to enter the integrated channel system in the southern part of the NTS and eventually make its way to the Amargosa River channel (ERDA, 1977).

3.5.2 Groundwater

The two regional groundwater systems that underlie the NTS are the Ash Meadows groundwater system and the Pahute Mesa system. The Ash Meadows system encompasses the eastern two-thirds of NTS while the Pahute Mesa system underlies the western one-third of the site. Groundwater from the Ash Meadows system generally flows from the north and east portions of the NTS in a southwest direction and ultimately discharges at Ash Meadows, southwest of the NTS. All of the landfill sites in Areas 9, 23 and 5 are in the Ash Meadows groundwater system. Beneath Frenchman Flat and Mercury Valley, the discharge of the Ash Meadows system is influenced by flow from the east (ERDA, 1977).

Groundwater flow occurs mainly through fractures in the carbonate and volcanic rocks. Velocities have been calculated at 180 to 18,000 meters (600 to 60,000 feet) per year for a portion of the carbonate aquifer in western Mercury Valley. Such high velocities would most likely be limited to the very short distances in which the aquifer is laterally confined by less permeable rocks. Velocities calculated for Yucca Flat range from 2 to 180 meters (6 to 600 feet) per year. Groundwater velocities beneath Frenchman Flat and Mercury Valley are influenced by the mixing of flows from the Ash Meadows system with flows from the east to result in values somewhere between those cited above for Yucca Flat and western Mercury Valley (ERDA, 1977).

A study of soil moisture flux indicates that less than 1 percent of the average annual precipitation moves downward through the soils. Due to the arid climate of the NTS, the flux gradient within the top 30 meters (100 feet) of soil is upward via evapotranspiration (O'Neill et al, 1993). The volcanic tuffs beneath Yucca Flat and Frenchman Flat have very low interstitial hydraulic conductivities, and vertical flow is limited to rates of less

than 0.05 meters (0.2 feet) per year. In a study conducted by Tyler et at (1992), bulk densities and hydraulic conductivities were obtained for core samples taken from beneath the U3fd crater and from outside the crater. There was little difference in the physical properties of samples taken at the respective locations. However, moisture contents within the disturbed soils were higher than in the undisturbed soils. Environmental tracer data indicated that the water moved faster and deeper in the disturbed alluvium, possibly due to water ponding in the crater.

At the NTS, depths to the water table range from approximately 220 meters (660 feet) beneath valleys in the southern part of the NTS to more than 500 meters (1,640 feet) beneath the Pahute Mesa. The water table is approximately 555 meters (1820 feet) below the ground surface at the Area 9 site. The Turf event, which was held in the 1960's and which resulted in the formation of the U10c crater was conducted approximately 154 feet above the water table. In Areas 23 and 5, the water table depth has been estimated at 243 meters (800 feet) and 235 meters (770 feet), respectively.

In Area 5, travel times to the water table from zone of equilibrium in an undisturbed site were estimated at 48,000 years (Fitzmaurice et al, 1995). The zone of equilibrium is a transition zone which separates the regions of upward and downward soil flux, and in which there is very little water movement. There are currently little or no data available regarding travel times to the water table from beneath the subsidence craters located in Area 9. However, with the depth of the water table in Area 9 being so much greater than that of Area 5, it can be assumed that travel times in Area 9 from either an undisturbed of disturbed area to the groundwater would be at least in the tens of thousands of years.

3.5.3 Water Supply

Groundwater from as many as 17 wells has supplied the demands of NTS operations. Eleven potable groundwater wells exist on the NTS. There are no potable groundwater wells within 3.2 kilometers (2 miles) of the landfills in Areas 9 and 23. In Area 5, Well 5b is located within 3.2 kilometers (2 miles) of the alternative C&D landfill. Hydrogeologic data indicate that the water table in the Frenchman basin is essentially flat with any gradient components lying within the uncertainty of the water table elevation measurements (Winograd and Thordarson).

3.6 Biological Resources

The NTS lies on the transition between the Mojave and Great Basin Deserts, and the flora and fauna include species characteristic of both deserts. A large portion of the NTS is vegetated by various associations of desert shrubs representative of either the Mojave, the Great Basin Deserts, or the transition zone. The southern portion of the NTS is dominated by plant communities typical of the Mojave Desert. Sagebrush and pinyon-juniper comprise much of the vegetation at the higher elevations. Herbaceous plants are also present at the NTS and are predominantly winter annuals or perennials. Typical vegetation in Area 23 and parts of Frenchman Flat include creosote bushes, white bursage, and shadscale. Area 9 is typified by a combination of Mojave and Great Basin Desert plants, including blackbrush, wolfberry, and hopsage (DOE, 1991).

The wide variety of animal species on the NTS is also indicative of the transition zone between the Mojave and Great Basin Deserts. The majority of the animals are small and often nocturnal. Several species of lizards, birds,and rodents inhabit the NTS. Snakes, rabbits, deer, coyotes and kit foxes can also be found throughout the site. Commonly found animals in Areas 9, 23, and 5 include side-blotched lizards, black-throat sparrows, kangaroo rats, jack rabbits and coyotes. The desert tortoise is a federally listed threatened species and has been found in Areas 5 and 23 (ERDA, 1977). It is the only threatened or endangered plant or animal species which exists on the NTS (DOE, 1991).

3.7 Cultural Resources

Various archeological sites have been identified on the NTS. Most of these sites were left by the ancestors of the

present-day Paiutes and Shoshones. These sites include rock shelters, brush houses, firepits used for cooking and, most commonly, scatters of artifacts on the ground surface. The most commonly found artifacts are stone tools, spear and arrow points, pieces of pottery and other durable materials.

The Area 9 and Area 23 landfills are, by nature of their operations, disturbed areas. It is therefore very unlikely that any cultural resources exist at these locations. The proposed location of the alternative C&D landfill in Area 5 is also disturbed. No archaeological sites have been reported in Frenchman Flat or the surrounding area, and it is unlikely that they exist there.

3.8 Socioeconomics

Currently, 2 individuals are required to operate each of the landfills in Area 9 and Area 23. Personnel include an attendant to log in waste loads and an operator to run the bulldozer and to maintain the landfill grounds. Operation of a new C&D Landfill in Area 5 would be similar and would also require 2 individuals.

3.9 Transportation

The Area 9 Landfill can be reached by using the Mercury Highway. The Area 23 Landfill is accessible from the Mercury Bypass Road. Access to a new C&D Landfill in Area 5 would be from the 5-01 Road if travelling north from Mercury or south from the RWMS. The Mercury Highway and the 5-05 Road would provide access if travelling south from the northern portion of the NTS.

4.0 ENVIRONMENTAL EFFECTS

4.1 Topography

Direct effects to topography could occur at the Area 9 Landfill if the proposed Class II and Class III covers required large amounts of soil. The soil for each cover would be excavated from two nearby locations and would result in the formation of two large pits. One of the pits would later be modified to form a retention basin after final closure of the landfill. The other pit would possibly be used to provide fill material during disposal operations. The topography of the Area 23 landfill would not be impacted beyond that resulting from existing operations. Construction of a new C&D landfill would result in very minor effects on the topography, since a pit already exists. Activities related to modifying the existing pit would include widening the access road and excavating a drainage ditch along the south and west sides of the landfill. Topography could be slightly affected if the offsite disposal option were chosen and a new processing facility were constructed. Under the no-action alternative, the topography would not be affected.

There would be no indirect effects to topography from the proposed action or alternatives.

4.2 Climate/Meteorology

The climate and meteorology would not be affected, directly or indirectly, by the proposed action or any of the alternatives.

4.3 Air Quality

During construction of the closure covers or new landfill, temporary effects to air quality would occur from particulate matter generated during grading and excavating activities and by wind erosion of exposed surface areas. Water would be sprayed onto the soil as needed to reduce airborne particulate matter during construction. Additional minor, temporary impacts would result from heavy equipment diesel exhaust emissions.

Effects on air quality during operation of the Area 23 Landfill are very minor, and are similar to those discussed

in the above paragraph. If the Area 23 landfill were the only landfill used, dust and diesel emissions would increase from the subsequent increase in disposal operations. For the offsite disposal option, impacts to the air quality in the vicinity of the NTS would be similar to those for construction of a new landfill if a Material Processing Facility were built. If the no-action alternative were chosen, activities at the landfills would cease, and there would be no effects to air quality.

There would be no indirect effects to air quality from the proposed action or alternatives.

4.4 Geology and Soils

The soils and geology would not be directly affected during construction of the closure cover, a new C&D landfill, or a Material Processing Facility.

Since the materials to be disposed of in the landfills are solid, the possibility that any leakage would occur is minimal. In addition, compacted soil liners would prevent leachate from leaving the landfill. There would be no direct effects to the soil and geology of the Area 23 landfill or for the no-action alternative.

There would be no indirect effects to the geology from the proposed action. Indirect effects to soils could include eventual erosion of the landfill covers by rainfall. Erosion would be prevented through periodic inspections and ongoing maintenance of the landfills.

4.5 Hydrology and Water Resources

The proposed action would not directly affect perennial surface water because no perennial surface waters exist. Contact with surface runoff would not be likely, as the probability of flash flooding at any of the landfill locations is very low. Berms could be utilized to prevent runoff from entering the landfills. Impacts to the surface water under the offsite disposal option could occur if leakage from the material processing facility came in contact with flood waters. This is considered very unlikely to occur. If a new facility were erected, the location would need to be examined for its proximity to any flood hazard zones. Under the no-action alternative, there would be no impacts to the surface water.

The groundwater and potable wells would not be directly affected by the proposed action or any of the alternatives.

The proposed actions could indirectly affect the groundwater by the migration of leachate from the landfills to the groundwater. This is unlikely to occur due to the nature of the waste, the extremely thick layer of unsaturated soil beneath the landfills, and because of the low leachate generation rate in an arid climate. As stated in Section 3.5.2, the soil moisture flux gradient in the uppermost layer of soil is upward via evapotranspiration. Therefore, any leachate originating from the landfill would likely evaporate without reaching the groundwater. In order to comply with state regulations, a system to monitor groundwater would need to be installed at the Area 9 and 23 landfills. Monitoring would indicate whether the groundwater quality is being adversely affected. The state of Nevada might suspend the requirements for monitoring groundwater if there was no potential for migration of hazardous constituents to the uppermost aquifer during the active life of the unit, including the period of closure and postclosure. Impacts to the groundwater would be negligible since the depth to the water tables in Areas 9, 23 and 5 are approximately 555, 243 and 274 meters (1820, 800 and 900 feet), respectively.

There would be no indirect effects to the groundwater if the offsite disposal or no action alternatives were chosen.

It is unlikely that potable water well 5b, which is within two miles of the alternative Area 5 landfill site, would be indirectly affected by any leachate created from the landfill. Since the construction and demolition waste entering the Area 5 landfill would consist of dry, inert material, the generation of any leachate would be highly unlikely.

4.6 Biological Resources

Soil for the Area 9 landfill covers would be excavated from two undisturbed sites, resulting in the direct loss of vegetation and displacement of animals over approximately 23 acres for the Class II cover and approximately 14 acres for the final cover. Since the range of the desert tortoise does not extend north to Area 9, there would be no loss of any threatened or endangered species. There would be no direct effects to biological resources at the Area 23 landfill, since this disposal site is already disturbed.

The proposed site for a new landfill in Area 5 is an old borrow pit which has undergone some revegetation. It is possible that construction and road work could directly affect vegetation and animals. If this alternative were chosen, a zone of influence survey would be conducted at the proposed Area 5 landfill area to determine the presence of the desert tortoise. If tortoise signs were found, then the proposed project would be subject to the terms and conditions for protection of the tortoise in the "Biological Opinion on Nevada Test Site Activities." All workers would be required to view the DOE/NV Desert Tortoise Protection Video and read the brochure associated with this film.

If the offsite disposal alternative was chosen, effects to the biological resources would depend on the site chosen for a Material Processing Facility The stipulations regarding the desert tortoise discussed in the previous paragraph would also apply to this alternative. Under the no-action alternative, there would be no direct effects to the Area 23 landfill.

Indirect effects from the no action alternative could include the eventual revegetation of the Area 23 landfill and rehabitation by animals.

4.7 Cultural Resources

Direct effects on cultural resources could include the destruction of historic properties and artifacts during grading and construction activities. Prior to initiating any surface disturbances, a cultural resource survey would be conducted to determine the presence of any artifacts or to identify historic properties that may be eligible for the National Register of Historic Places (NR). NR eligibility would be determined through consultation with the National Division of Historic Preservation and Archeology (NDHPA). Adverse effects to historic properties that could not be avoided would be mitigated through data recovery. The data recovery plan would be established through consultation with the NDHPA and the Advisory Council on Historic Preservation.

Steps would be taken to ensure that currently unknown archaeological resources that may be present subsurface are not adversely impacted. Construction crews would be instructed to stop all activities in the immediate vicinity and notify DOE/NV Environmental Protection Division if cultural resources were encountered during construction. An analysis of the find would be made by qualified archaeologists, and the State Historic Preservation Officer would be consulted so that a concurrence could be obtained regarding the significance of the discovery.

Under the no-action alternative there would be no direct or indirect effects to cultural resources.

4.8 Socioeconomic Effects

Construction of a soil cover or a new landfill would take three to four months and would require numerous workers for excavation and dirt hauling activities. Under the no-action alternative, operators could be directly affected by closure of the Area 23 landfill. Installation of a processing facility under the offsite disposal option would require numerous workers to construct the facility. Additional truck drivers might be needed to transport the wastes off site.

Indirect effects from operating the landfills include periodic grading and weed control which would require one or two workers. Installation of a processing facility under the offsite disposal option would require several

personnel to operate it. Additional drivers might be needed to transport the wastes offsite.

4.9 Health Effects

Direct effects to workers during the construction of the Area 9 soil cover, the landfills and the offsite certification building would be minimal. Use of heavy equipment could produce a temporary noise hazard for the workers. Workers potentially exposed to noisy conditions would use hearing protection, as specified in REECo Safety Procedure IH-1, "Mandatory Hearing Protection." There would be no effects to site personnel since none of the landfills are located near offices or work areas.

Indirect effects to workers during operational activities would be similar to those incurred during construction. There would be no indirect effects to site personnel since none of the landfills are located near offices or work areas.

4.10 Transportation Effects

Direct effects of transportation during the construction and operation of the proposed C&D landfill, the Area 9 closure cap, and the Material Processing Facility would be limited to diesel emissions and dust from trucks transporting construction materials and wastes. Transportation of these materials would generate dust as the trucks travelled over the dirt roads that accessed the landfills. State regulations require that the dust generated in this manner be controlled through the spraying of water or by other measures. Use of a single landfill for disposal would result in increased truck traffic. Travel time would also increase for haulage of wastes from the north part of the NTS. Under the no-action alternative, transportation would decrease or stop and there would be no direct effects.

Indirect effects from use of a single landfill would include more wear on the Mercury bypass road. Transporting wastes from a Material Processing Facility to an offsite location would result in increased wear on the trucks and possibly the purchase of larger trucks to accomodate greater loads of bulk materials. There would be no indirect effects under the no-action alternative.

5.0 CUMULATIVE IMPACTS

Cumulative impacts from construction of a soil cover and continued operation of the Area 9 disposal site as a Class III landfill would be minimal. Since the landfill is located in an isolated portion of the NTS, continued operation would not affect present actions. Future activities in this portion of the NTS will most likely be confined to clean up and restoration projects.

A new C&D Landfill in Area 5 could result in increased traffic on the 5-01 Road. This road also provides access to the RWMS and Liquid Gaseous Fuels Spill Test Facility (LGFSTF). Due to the nature of operations at the RWMS, a large portion of traffic to this facility consists of diesel trucks. It is anticipated that future activities at the RWMS will increase and subsequently result in increased truck traffic. The LGFSTF may also increase testing activities, which could result in portions of the 5-01 Road being closed to traffic. This would not restrict access to the Area 5 landfill, since it may be accessed via other routes. Plans are being developed to either rebuild one of the existing access roads to Area 5 and the RWMS or to construct a new road, which would alleviate any potential traffic problems.

Under the no-action alternative, current activities at the NTS would be greatly impaired and could result in a reduced work force. Many of the approximately 3,000 NTS personnel would no longer be employed. Those who could not find employment in Las Vegas or nearby Pahrump would be forced to relocate to another state, which could have an impact on the local economy.

Continued operation of the Area 23 landfill would result in a larger disturbed area, but otherwise would not impact other activities on the NTS.

6.0 ACCIDENT SCENARIOS

The probability of a major accident occurring at the landfills during construction, modifications or operation is low. Scenarios of those accidents more likely to occur are described below:

- Heavy Equipment Accidents. Injuries could occur to workers during the manipulation of scrapers, forklifts and other equipment.

  Building 650 in Area 23 houses a medical facility for treatment of minor injuries. For serious injuries, ambulances stationed at the medical facility provide quick access to hospitals located in Las Vegas.

- Fall in Landfill. It is possible that personnel could fall on a sloped surface within the landfill while performing maintenance tasks.

  The landfill will be approximately 15 feet deep. A minimum of two workers would be present at the landfills during routine operations and maintenance activities, so that in the event of an accident the victim would be aided by his or her coworker.

- Natural Catastrophes. Natural catastrophes which could occur include flooding and earthquakes.

  Preliminary data indicates that none of the three landfill sites are located in a 100-year flood hazard zone (Raytheon Services Nevada, 1993). Appropriate measures would be taken to divert any 100-year flood hazard (ie. construction of flood diversion dikes, etc) if this assessment changes. Berms could be utilized to prevent runoff from entering the facility. The existing Area 23 landfill already has flood diversion areas built around it which are being examined to determine if they meet state requirements.

  The probability of earthquakes occurring at the existing and new landfill sites is low. However, if an earthquake did occur, a visual survey would initially be conducted to assess damages. Appropriate actions would be taken to repair cell walls and other structures.

If there was no action taken, the landfills would be closed and there would be no accidents related to operation of the landfills.

Accidents occurring during offsite disposal of wastes would be related to malfunctions of trucks or traffic accidents. Response to either one of these situations would depend on the location of the incident. The NTS maintains an ambulance which could respond to accidents north of Indian Springs. Accidents occurring south of Indian Springs would be handled by Las Vegas facilities.

Accidents incurred through operation of a single landfill would be similar to those described under the proposed action.

7.0 COMPLIANCE WITH OTHER REGULATIONS

7.1 Clean Water Act

A proposal to construct a sewage lagoon system in Area 5, approximately four miles north of the proposed C&D Landfill, has been reviewed and approved by the state of Nevada. When the sewage lagoons are constructed, they will be regulated under state of Nevada, Water Pollution Control General Permit Number GNEV93001. It is not anticipated that construction and operation of a landfill in Area 5 would affect or be affected by operation of the lagoons.

7.2 Clean Air Act

The control of fugitive dust from construction, operation and maintenance activities is required in accordance with NAC 445.734: "No person may cause or permit the handling, transporting or storing of any material in a manner which allows or may allow controllable particulate matter to become airborne." Fugitive dust from unpaved roads must also be controlled under NAC 445.734.

Activities which involve disturbing an area greater than five acres are required to be reported under state of Nevada Air Quality Operating Permit No. 2743. Excavation of soil for Class II and Class III covers would disturb approximately 23 acres and 14 acres, respectively, and would therefore need to be reported. It is not anticipated that construction of a new landfill in an existing borrow pit or a Material Processing Facility would disturb more than 5 acres of a previously undisturbed area; however if this were to occur, the disturbance, including the dates and location of the activity, would need to be reported to the state.

7.3 Safe Drinking Water Act (SDWA)

It is not anticipated that construction and operation of the proposed C&D landfill or closure cover would be affected by the SDWA regulations. The potable water well that is within two miles of the Area 5 proposed landfill site is not expected to be affected by any leachate created from the landfill.

7.4 RCRA

The design, construction, operation, and closure of the solid waste landfills in Areas 9, 23 and 5 would be covered under RCRA. The regulations that govern solid waste landfills can be found in 40 CFR 258.1.

8.0 CONCLUSION

The need for a practical, cost-effective, and environmentally-sound means of solid waste disposal for the NTS remains and will remain into the future. A summary of the advantages and disadvantages for the proposed action and alternatives is shown in Table 1. With the exception of the no-action alternative, the proposed action and alternatives could achieve compliance with existing state of Nevada regulations and allow the NTS to continue to operate normally.

Table 1. Comparison of Proposed Action with Alternatives

Proposed Action	Advantages	Disadvantages
(Use Area 9 and Area 23 Landfills)	• Complies with state regulations • 70 year life span for Class III disposal • Less expensive than other landfill options • Approximately 100 year life span for Area 23 landfill	• Disturbance to approx. 23 acres of land for Area 9 Class II cover • Disturbance to approx. 14 acres of land for Class III final cover and retention basin (Area 9)
New C&D Landfill	• Complies with state regulations • Utilizes existing borro pit • Approximately 100 year life span for Area 23 landfill • Satisfies current requirements and allows for	• Disturbance to several acres of land • Disturbance to approx. 14 acres of land for Class III final cover and retention basin (Area 9)

	possible increases	
No Action	• No construction costs • No construction-related disturbances to the environment	• Does not comply with state regulations • Civil penalty of up to $5000 per day
Single Landfill	• Complies with state regulations • Lower operating and maintenance costs • No construction costs • No additional disturbance to land	• 14 year life span • Increased travel time for C&D wastes • Disturbance to approx. 14 acres of land for Class III final cover and retention basin (Area 9)
Offsite Disposal	• Complies with state regulations • Lower maintenance costs	• Closest site 145 km (90mi) away • Most expensive • RCRA "Cradle to Grave"regulations • Disturbance to approx. 14 acres of land for Class III final cover and retention basin (Area 9)

9.0 AGENCIES AND PERSONS CONSULTED

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